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## N°. XXIV.

*Barometrical Measurement of the Blue-Ridge, Warm-Spring, and Alleghany Mountains, in Virginia, taken in the Summer of the year 1791.*

Mount Pleasant on Schuylkill, Nov. 13, 1795.

DEAR SIR,

Read Nov.  
20, 1795.

THE enclosed Journal would have been long since presented to the Philosophical Society if I had been satisfied as to the accuracy of barometrical calculations, when applied to the measuring of heights in this climate; but finding much variation in repeated experiments made at a known height,\* in winter, spring and summer, I grew discouraged, and my labours would have passed into oblivion if the advice of our worthy President and yourself had not induced me to present my Journal as it is, disregarding the errors incident to local circumstances and small elevations, which may not affect the principle of barometrical measurement on a more extended scale.

I have used the table you favoured me with, making proportionate calculations for every deviation from 30 inches of the mercury; this I have compared with the calculated height of the Andes, in Don Ulloa's Voyages, and the ascent of Mr. Charles in the balloon at Paris, described by M. Faujas de St. Fond; the result of these comparisons has so well confirmed the accuracy of the table, that I have no doubt of my calculations being proportionate to those of Europe and South-America.

\* The highest accessible part of Christ's Church Steeple, inside, is 166 feet from the ground. By barometrical measurement it varied from 105, to 243 feet.

I beg leave however to mention some circumstances which, as far as I am informed, seem peculiar to this country.

1. The atmospherical changes in Europe, generally cause the mercury in the barometer to rise and fall three inches, in the course of a year.

2. In Williamsburg (Virginia) the greatest change in the course of a year has been observed to be 1.86.

2. At Monticello, about 20 miles east of the Blue Ridge, and about 500 feet high, the greatest variation in nine months was\* 1.21: though the relative changes were simultaneous with those at Williamsburg.

4. During 11 days residence at Staunton (1055 feet high) and 29 at the Red Springs (1512 feet high) the barometer at the former place did not vary more than 0.40, and at the latter only 0.20, while the thermometer varied more than 30 degrees, and the weather was at the extremes of clear and dry, and cloudy with heavy rains.

It seems therefore that the barometer is less susceptible of change in Virginia than in England, and still less as you ascend among the mountains; and it may not be thought improbable that a regular meteorological journal kept at the same time in several places during a year, would show a sort of gradation in these changes.

The lower part of the atmosphere, in addition to its own gravity, supports all above it; its moisture is liable to expand prodigiously from the rays of the sun reflected in every direction, and other causes of heat; and to be very suddenly condensed by cold: The winds, impeded by many obstacles, such as trees, rocks, and eminences of land, are generally irregular and violent, like water rushing over a rude and rapid descent; while, in a superior region the air glides smoothly along like a current in the ocean. It

\* Mr. Jefferson's Notes, p. 83 and 85.

seems from these causes that inaccuracies are most likely to occur in the first stage of ascent: Hence I am inclined to think that the Blue Ridge is not estimated high enough. These objections do not occur in so great a degree in the high country.

Mr. Jefferson supposes the Peaks of Otter to be about 4000 feet high. This place is about 60 miles S. W. of that where I crossed, I had therefore no opportunity of seeing it.

Please to observe that my undertaking these experiments was incidental to my having occasion to make the journey: had it been a preconcerted plan, more accurate and more minute observations might have been expected. If it should be found interesting enough to deserve the notice of the Society, I shall be abundantly gratified.

I am, with great Respect and Esteem,

Your most Obedient Servant.

JONATHAN WILLIAMS.

*To Mr. R. Patterson.*

P. S. If on examination there should be reason to believe these heights tolerably accurate, the height of Richmond from the sea should be added to each elevation.

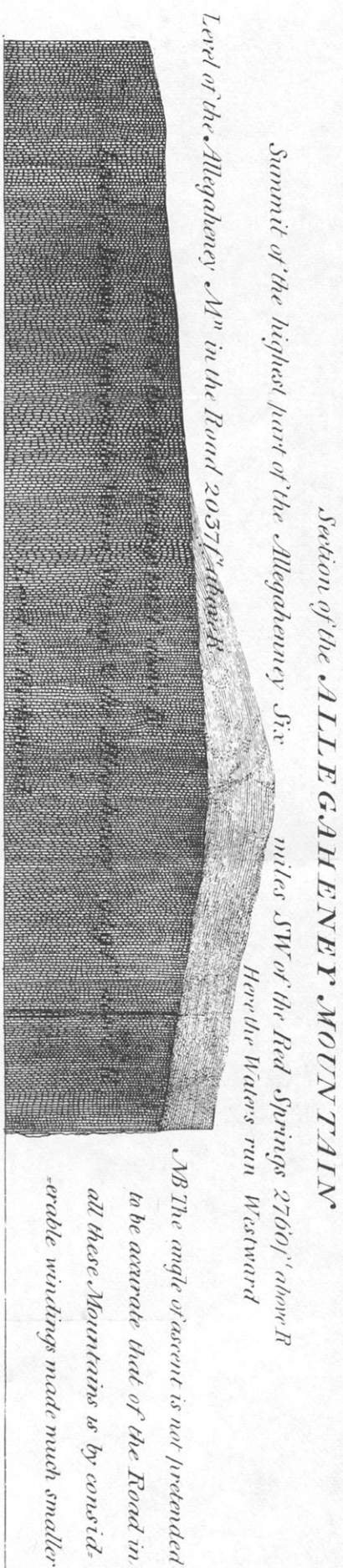
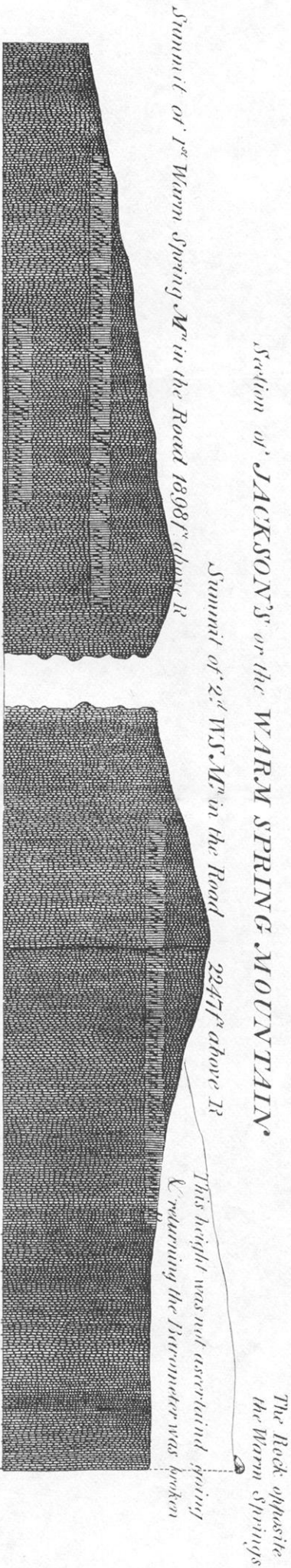
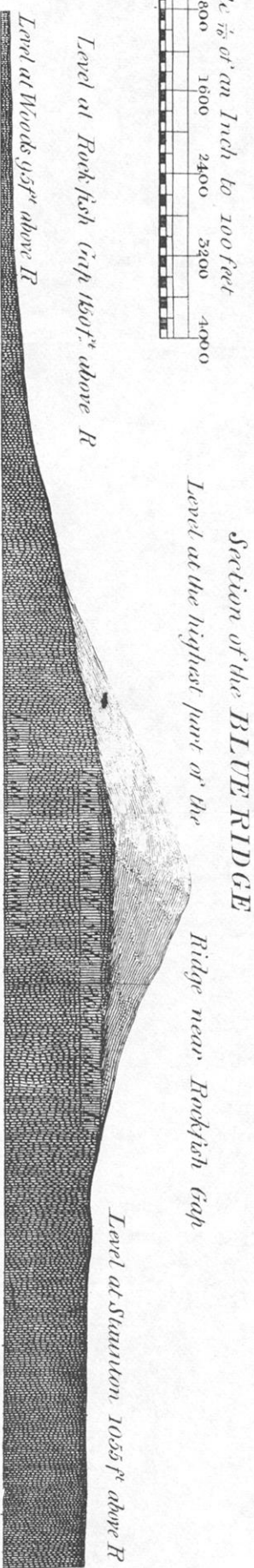
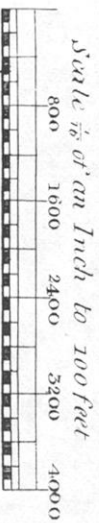
*A Meteorological Journal, made with a View to discover the Height of the Country, at various Places, from Richmond, to the Alleghany Mountains in Bottetourt, Virginia.—1791.*

| Places.                          | Dates.  | Time of Day. | Ther. Faren. | Barometer. |         | Weather. | Dist. in Miles. | Diff. of Barometer. falling. | Diff. of Barometer. rising. | Ascent in feet. | Descent in feet. | Height above Richmond. |
|----------------------------------|---------|--------------|--------------|------------|---------|----------|-----------------|------------------------------|-----------------------------|-----------------|------------------|------------------------|
|                                  |         |              |              | Inches.    | 100ths. |          |                 |                              |                             |                 |                  |                        |
| Richmond                         | June 26 | Sun rise     | 70           | 29         | 80      | Fair     | 0               |                              |                             |                 |                  |                        |
| Allen's                          |         | 10 A. M.     | 78           | 29         | 80      | Ditto    | 18              |                              |                             |                 |                  |                        |
| Leake's                          |         | Sun set      | 75           | 29         | 60      | Showers  | 32              |                              |                             |                 |                  |                        |
| Ditto                            | 27      | Sun rise     | 66           | 29         | 60      | Fair     | Do.             |                              |                             |                 |                  |                        |
| Payne's                          |         | Noon         | 75           | 29         | 60      |          | 40              |                              |                             |                 |                  |                        |
| Charlottesville                  | 28      | Noon         | 78           | 29         | 80      | Do.      | 80              | 0.10                         |                             | 95              |                  | 95                     |
| Wood's                           | 29      | Sun rise     | 65           | 29         | 70      | Do.      | 90              | 1.10                         |                             | 1055            |                  | 1150                   |
| a Rockfish Gap in the Blue Ridge |         | 10 A. M.     | 76           | 28         | 60      | Do.      | 104             | 0.70                         |                             | 672             |                  | 1822                   |
| Mountain Top                     |         | 2 P. M.      | 79           | 27         | 90      | Do.      |                 |                              |                             |                 |                  |                        |
| The Gap again                    |         | 3 P. M.      | 79           | 28         | 60      | Do.      |                 |                              |                             |                 |                  |                        |
| Ditto                            | 30      | Sun rise     | 70           | 28         | 40      | Rain     |                 |                              |                             |                 |                  |                        |
| Foot of the Blue Ridge Westward  |         | 6 A. M.      | 75           | 28         | 90      | Do.      | 105             |                              | 1.00                        |                 |                  | 863                    |
| b Staunton                       |         | Sun set      | 73           | 28         | 70      | Cloudy   | 120             | 0.20                         |                             | 192             | 959              | 1055                   |
| Ditto                            | July 3  | Sun rise     | 55           | 29         | 10      | Fair     |                 |                              |                             |                 |                  |                        |
| Eckhard's                        | 12      | 5 A. M.      | 60           | 28         | 92      | Do.      | 128             |                              |                             |                 |                  |                        |
| Alexander's                      |         | 5 P. M.      | 66           | 28         | 50      | Gulf     | 140             |                              |                             |                 |                  |                        |
| Huggard's.                       | 13      | 5 A. M.      | 61           | 28         | 62      | Fair     | 146             |                              |                             |                 |                  |                        |

*A Meteorological Journal continued. 1791.*

| Places.  | Dates.  | Time of Day. | Therm. Faren. | Barometer. |        | Weather. | Dist. in Miles. | Diff. of Barometer Falling. | Diff. of Barometer Rising. | Ascent in Feet. | Defect in Feet. | Height above Richmond. |
|--|---------|--------------|---------------|------------|--------|----------|-----------------|-----------------------------|----------------------------|-----------------|-----------------|------------------------|
|  |         |              |               | Inches.    | 100ths |          |                 |                             |                            |                 |                 |                        |
| M. Clung's   | July 13 | 9 P. M.      | 73            | 28         | 80     | Fair     | 163             |                             | 0.12                       |                 | 112             | 943                    |
| Foot of Mountain                                     | 14      | 5 A. M.      | 63            | 28         | 82     |          | 166             |                             | 0.12                       |                 | 112             | 943                    |
| Top of 1st Mountain                                  |         | 11 A. M.     | 82            | 27         | 80     | Ditto    | 167             | 1.02                        |                            | 955             |                 | 1898                   |
| Top of 2d do.  |         | Noon         | 77            | 27         | 44     | Do.      | 168             | 0.36                        |                            | 349             |                 | 2247                   |
| Foot of do.  |         | 1 P. M.      | 77            | 23         | 03     | Showers  | 169             |                             | 0.59                       |                 | 562             | 1685                   |
| Morris's   |         | 8 P. M.      | 61            | 28         | 67     | Fair     | 178             |                             | 0.64                       |                 | 614             | 1071                   |
| Brown's  | 15      | 8 A. M.      | 67            | 28         | 80     | Foggy    | 201             |                             | 0.13                       |                 | 122             | 949                    |
| Red Springs  | 16      | 9 P. M.      | 66            | 28         | 20     | Rain     | 217             | 0.60                        |                            | 563             |                 | 1512                   |
| e Ditto  | 24      | 6 A. M.      | 66            | 28         | 30     | Fair     | Do.             |                             |                            |                 |                 |                        |
| Ditto  | 26      | 6 A. M.      | 65            | 28         | 11     | Hardrain | Do.             |                             |                            |                 |                 |                        |
| Alleghaney Moun-<br>tain highest part of<br>the Road | 31      | Noon         | 80            | 27         | 64     | Fair     | 223             | 0.56                        |                            | 525             |                 | 2057                   |
| f Top of the Ridge                                   |         | 5 P. M.      | 76            | 26         | 86     | Do.      | 224             |                             |                            | 723             |                 | 2760                   |
| g Red Springs again                                  |         | 8 P. M.      | 77            | 28         | 24     | Do.      | 217             | 0.78                        |                            |                 |                 |                        |
| Ditto  | Aug. 14 | 6 A. M.      | 61            | 28         | 28     | Do.      |                 |                             |                            |                 |                 |                        |

*Notes.*



Height of **VIRGINIA MOUNTAINS** by Barometrical measurement by **Jon.<sup>d</sup> Williams, Jun.<sup>r</sup>**

*Notes.*

*a.* From the foot of the Blue-Ridge to the Gap is called two miles. From the Gap to the foot on the western side it is called one mile.

*b.* During eleven days residence at Staunton and in 33 observations, the mercury in the barometer did not rise above 29.10, nor fall below 28.70. The thermometer varied from 55 to 82, and the weather was sometimes very clear and dry, and sometimes very cloudy with hard rain.

*c.* These are called Warm-Spring Mountains, the Warm Springs being near the foot at the western side.

*d.* This is not the top of the Ridge; I could not go up at this time, and when I returned I had not my barometer: By ocular observation it appeared to me nearly, if not quite, as high above the road on the first mountain as the top of the Blue Ridge above the Gap.

*e.* During 29 days residence at the Red Springs, the mercury in the barometer varied only 0.19; the thermometer varied 31 degrees and the weather was at the two extremes of wet and dry.

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### POSTSCRIPT.

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WHILE the foregoing was under the consideration of the committee of selection and publication, I sent a transcript to Mr. Jefferson, requesting him to furnish me with such facts on this subject as had been established by experiment. In return he favoured me with the following answer.

F f

“ DEAR



Monticello, July 3d. 1796.

“ DEAR SIR,

“ I EXAMINED with great satisfaction your barometrical estimate of the heights of our mountains, and with the more as they corroborated conjectures on this subject, which I had made before. My estimates had made them a little higher than yours, (I speak of the Blue Ridge). Measuring with a very nice instrument, the angle subtended vertically by the highest mountain of the Blue Ridge opposite to my own house, a distance of about 18 miles south-westward, I made the height about 2000 feet, as well as I can remember, for I can no longer find the notes I then made. You make the south side of the mountain near Rock-fish Gap 1727 feet above Wood's. You make the other side of the mountain 768 feet. Mr. Thomas Lewis deceased, an accurate man, with a good Quadrant made the north side of the highest mountain opposite to my house something more (I think) than 1000 feet. But the mountain estimated by him and myself is probably higher than that next Rock-fish Gap. I do not remember from what principles I estimated the peaks of Otter at 4000 feet, but some late observations of Judge Tucker's coincided very nearly with my estimate. Your measures confirm another opinion of mine, that the Blue Ridge on its south side is the highest in our country, compared with its base. I think your observations on these mountains well worthy of being published, and I hope you will not scruple to let them be communicated to the world.

I am, &c.

(Signed) TH: JEFFERSON.”

When

When it is considered that in measuring a height by taking the vertical angle, the refraction of the rays of light in the atmosphere must affect the appearance of the objects, it will occur that this mode must be subject to some inaccuracy; and as this refraction generally tends to *increase* the apparent height, a reasonable allowance on the experiments mentioned by Mr. Jefferson would probably bring them down to the barometrical measurement. This observation is beautifully illustrated by Mr. Jefferson's account of a phenomenon resembling, in some measure, an appearance which seamen call *looming*;\* and which (so far as relates to apparent size at least) may be accounted for by refraction. On the other hand barometrical measurement, is probably inaccurate in the lower stages of the atmosphere; but this tends to *lessen* the apparent height: The truth may therefore lie between.

I am, as before,

Dear Sir, sincerely yours,

JONATHAN WILLIAMS.

Philadelphia, }  
Aug. 18, 1796. }

*To Mr. R. Patterson.*

\* Jefferson's Notes, page 89.